

Abstracts of Technical Articles from Bell System Sources

*Recent Observations on the Relation between Penetration, Infection and Decay in Creosoted Southern Pine Poles in Line.*¹ C. H. AMADON. The relation between poor penetration and decay, and the necessity for rational and adequate penetration requirements in treating specifications, are now fairly well understood by producers and users of creosoted southern pine poles. The purpose of this brief paper is to supplement the information presented in the Proceedings for 1936 and 1937 on the behavior of these poles in line under actual service conditions.

*Tarnish Studies. The Electrolytic Reduction Method for the Analysis of Films on Metal Surfaces.*² W. E. CAMPBELL and U. B. THOMAS. A method is described for analysis of tarnish films on metals by electrolytic reduction at the cathode. Its suitability is demonstrated for the rapid and accurate measurement of oxide films on copper varying in average thickness from monomolecular layers to 1000 Å. It is shown to be useful for reduction of mixed oxide-sulfide films on copper and silver. The method is used to measure the oxide films on freshly reduced copper after one-half hour's exposure to oxygen or air. Such films are shown to be 10–20 Å thick. A thicker film, measuring 30–70 Å is found to be produced by abrasion of copper in air, water, benzene or toluene. Adaptations and modifications are discussed which give wide analytical application to the method.

*An Electrochemical Study of the Corrosion of Painted Iron.*³ H. E. HARING and R. B. GIBNEY. The corrosion protective value of approximately 50 different paints was determined by means of an electrochemical method which has been previously described. This determination involved the measurement of the change in the potential of the painted iron with time when wet with water for 24 hr. or less. It was found that the interpretation of the time-potential curves which were automatically plotted by a recording vacuum tube electrometer, was facilitated if the test was conducted in a nitrogen atmosphere. The results obtained with the electrochemical or potentiometric method compared favorably with those obtained in a

¹ *Proc. American Wood-Preservers' Association*, 1939.

² *Electrochemical Society Preprint* 76–25.

³ *Electrochemical Society Preprint* 76–24.

one-year outdoor exposure test. Such differences as were found were shown to be due either to deterioration or improvement in the paint film as the result of weathering.

*Characteristics of Modern Microphones for Sound Recording.*⁴ F. L. HOPPER. Factors influencing the choice of a microphone for sound recording are considered. The characteristics of a new miniature condenser transmitter and amplifier, as well as a number of other types of microphones now in use, are included.

*Cold-Cathode Gas-Filled Tubes as Circuit Elements.*⁵ S. B. INGRAM. The application of electronic devices to the local systems plant is still in its infancy. One of the first of these devices to receive extensive use is the cold-cathode gas-filled tube. As a sensitive relay it is beginning to make its appearance in a number of telephone control and signaling circuits, being best known for its use in the standard four-party subscriber set where its rectifying property enables it to discriminate between positive and negative polarity for selective ringing. Compared with other types of vacuum tubes the cold-cathode tube has the advantages that it operates without cathode heating power, has the ability to start immediately when a signal is applied, and does not deteriorate when not passing current. These advantages make it particularly suitable for use in telephone circuits where intermittent service is common and long life and economical operation are required.

The paper describes the structure and electrical characteristics of cold-cathode tubes. Their properties as circuit elements are then illustrated in a number of typical basic circuits.

*Inductive Coordination with Series Sodium Highway Lighting Circuits.*⁶ H. E. KENT and P. W. BLYE. This paper describes the wave-shape characteristics of the sodium-vapor lamp and discusses the relative inductive influence of various series circuit arrangements in which such lamps are employed. A method is outlined by means of which the noise to be expected in an exposed telephone line may be estimated. Measures are described which may be applied in the telephone plant or in the lighting circuit to assist in the inductive coordination of the two systems. These measures need be considered only when a considerable number of lamps is involved, since noise induction is negligible

⁴ *Jour. S.M.P.E.*, September 1939.

⁵ *Elec. Engg.*, July 1939.

⁶ *Elec. Engg.*, July 1939.

when there are only a few lamps as, for instance, at highway intersections.

*A Cardioid Directional Microphone.*⁷ R. N. MARSHALL and W. R. HARRY. A microphone is described which has uniform directivity over a wide frequency range. This is made possible by placing in a single instrument a dynamic type pressure microphone element and a ribbon type "velocity" element, and electrically equalizing the outputs before combination. The resultant directional pattern is a heart-shaped curve or cardioid, giving a fairly wide pick-up zone in front and a substantial dead zone at the back of the instrument. Because of the unusually rugged ribbon employed, the new microphone is much less susceptible to wind noise than ordinary ribbon types. Housed in an aluminum case, the microphone weighs only $3\frac{1}{4}$ lbs. High output level, low impedance, and high quality, together with the excellent directivity, promise to make the cardioid microphone an important tool for the motion picture sound engineer.

*Fractional-Frequency Generators Utilizing Regenerative Modulation.*⁸ R. L. MILLER. By the application of the principle of regeneration to certain modulation systems, a generator of submultiple or other fractional-frequency ratio may be obtained.

A simple example is obtained by considering a second-order modulator whose output is connected back to a conjugate input by means of a feedback loop including an amplifier and a selective network. If an input frequency f_0 is applied, it is found that a frequency component $f_0/2$ appearing in the feedback path will modulate with the applied frequency to produce sidebands of $f_0/2$ and $3f_0/2$. The network and amplifier, being especially efficient for the frequency $f_0/2$ and having a gain higher than the modulator loss, will reinforce this component causing it to build up to some steady-state value. Similar processes are possible by which greater submultiple ratios may be obtained.

Since the output wave is obtained by a modulation process involving the input wave, it will appear only when an input is applied and then bears a fixed frequency ratio with respect to it. Experiments show that the ability of the generator to produce a fractional frequency is independent of phase shift in the feedback path. Circuits are possible in which the amplitude of the fractional-frequency wave will bear a linear relation to the input wave over a reasonable range and at the

⁷ *Jour. S.M.P.E.*, September 1939.

⁸ *Proc. I.R.E.*, July 1939.

same time maintain a constant phase angle between the two waves. Typical circuits are discussed which make use of copper oxide as the modulator elements.

*Seasonal Cosmic-Ray Effects at Sea Level.*⁹ R. A. MILLIKAN, H. V. NEHER and D. O. SMITH. By sending a Neher self-recording electroscope in a 10-cm lead shield repeatedly on a slow Norwegian steamer over the route Vancouver-Los Angeles, around South America and return to Los Angeles and Vancouver, we find (1) as heretofore an equatorial dip measured from Los Angeles of seven per cent on the western side of South America, eight per cent on the eastern side; (2) no measurable seasonal effect, or winter-summer differences, at all in the voyage from Los Angeles to the Straits of Magellan; (3) as heretofore constancy in cosmic-ray intensity in summer and fall, within the limits of uncertainty imposed by fluctuations estimated at not over one per cent, on the voyage between Los Angeles and Vancouver; (4) but in winter and spring an increase of as much as two or three per cent between Los Angeles and Vancouver. This is interpreted as the atmospheric-temperature effect earlier studied by Hess, Compton, and their respective collaborators.

*Some Engineering Considerations in Loading Circuits.*¹⁰ J. A. PARROTT. This paper describes the various loading arrangements used on toll entrance and intermediate cable circuits and discusses the transmission benefits obtained by loading and some of the important problems in the consideration of loading railroad entrance and intermediate cables. In addition to voice frequency loading, loading for the lower frequency carrier systems such as the Type H is also discussed.

*The Formation of Metallic Bridges between Separated Contacts.*¹¹ G. L. PEARSON. Low resistance bridges were formed between gold, steel and carbon electrodes having separations of $2-70 \times 10^{-6}$ cm by applying voltages less than the minimum sparking potential. For a given pair of electrodes the field required to form the bridges is a constant and is $5-16 \times 10^6$ volts per centimeter. Measurements of the temperature coefficient of resistance of the bridges identify them as consisting of the material of the electrodes. A study of their resistance as a function of the displacement of one of the electrodes shows that they may be pulled out as well as crushed. At voltages

⁹ *Phys. Rev.*, September 15, 1939.

¹⁰ *Proc., Assoc. Amer. R.R., Telegraph and Telephone Section*, April 1939.

¹¹ *Phys. Rev.*, September 1, 1939.

less than those required to form the bridges, field currents exist. These increase rapidly as the field is raised and attain a value around 10^{-10} ampere before the bridges are formed. Calculation of the maximum electrostatic stress on the electrodes at the time of breakdown gives a value 0.05 to 0.0005 times the tensile strength of the electrode material at room temperature. The field is locally higher than that calculated because of surface roughness and the tensile strength is probably lowered by the local heating known to accompany field currents. The data therefore indicate that electrostatic force pulls material from the electrodes to bridge the gap.

*Measuring Transmission Speed of the Coaxial Cable.*¹² J. F. WENTZ. Time of transmission of carrier currents over high speed lines is discussed. A method of measuring this time delay as used on the 1000-kc system of the New York-Philadelphia coaxial cable is described and the results are given for the television band transmitted over it experimentally.

¹² *Bell Labs. Record*, June 1939.